A simple hydrostatic cylinder lubricator.

The following is a précis of an article by Keith Gammage which appeared in the Model Engineer volume 182 No. 4091 dated 9-22 April 1999.

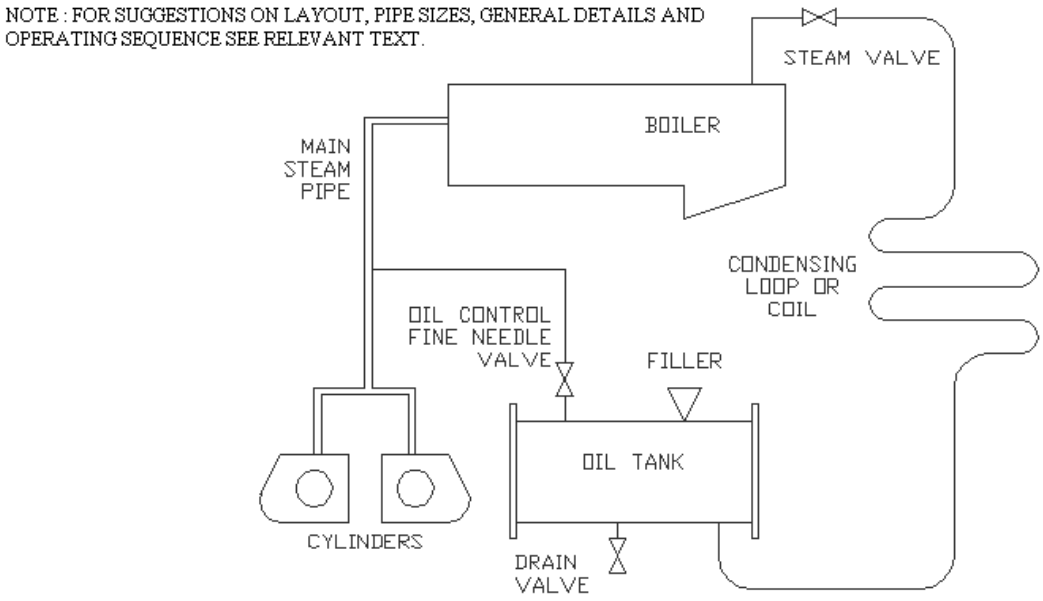
Some locomotives which use mechanical lubricators are prone to smothering themselves, the driver and passengers with cylinder oil. When he built his Simplex Keith was determined to control the oil flow to the cylinders so that only a minimum of surplus oil was blown up the chimney. This was particularly important since he was going to install a spark arrestor and an excessive amount of oil would cause this to choke.

Most locomotives are fitted with mechanical lubricators which in the early days seemed to present problems including uncontrollable oil flow or water back through the clack. Only one, with a bypass valve back into the oil tank seemed to offer some form of control. Things have moved on since those days, with reliable designs with roller clutches or controllable pumps being available.

A sophisticated hydrostatic system was described by Fred Cottam in the ME (ME 3331 & ME 3332, November 1967). This is an excellent system, totally controllable and reliable, but with many parts to make. Keith was looking for a simpler solution.

The solution Keith came up with was based on the system on a 31/2 Princess Marina built by a fellow club member, and worked faultlessly for the 20 years Keith owned his Simplex.
Hydrostatic systems all work on the same principles, they are steam fed from the backhead manifold by way of a condensing coil to a pressure tank containing steam oil. The condensed steam falls to the bottom of the tank, pushing the oil out of the tank via a fine needle valve to the cylinders. The volume of oil fed is infinitely controllable and is only dependent on the differential pressure between the boiler and steam chest and the setting of the needle valve. It must not be forgotten however that the oil tank is a pressure vessel subject to full boiler pressure and must be treated as such.

Comprising only of an oil tank, steam supply valve, tank drain valve and an oil control valve, together with steam and oil pipework, the system is simple and quick to make.



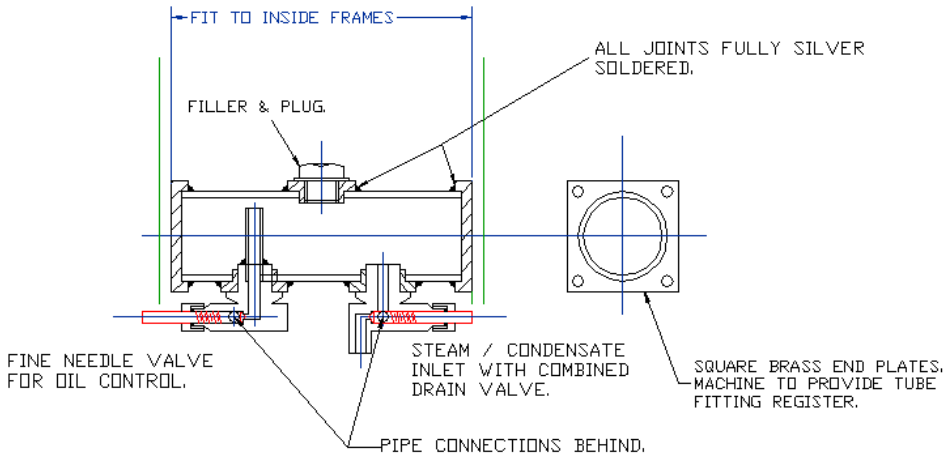
SCHEMATIC DIAGRAM OF SIMPLE HYDROSTATIC OILING SYSTEM.

Oil tank.

The oil tank used by Keith was a horizontal vessel sandwiched between the frames. There are usually two possible locations for this, either under the cab floor or between the buffer beams. They both work equally well. Easy access to the filler and drain are essential, together with the oil valve if this is fitted to the tank.

The system diagram shows the drain and steam inlet as separate connections on the bottom of the tank, with the oil and filler both on the top. This is the true theoretical layout, but is not always practical.

The tank as shown on the section drawing has three bushed connections. At the top is the filler which is best in the centre. At the bottom are two smaller bushes, one for a steam inlet combined with an inlet valve, the second for the oil outlet connection.



GENERAL ARRANGEMENT OF OIL TANK AND VALVES

Whichever layout of connections is chosen they are very dependant on the tanks size and its location which has to be the builder's choice. The oil must always come from the top of the tank, so if this connection is on the bottom then an internal pipe, as shown, is essential.

The tank construction is very simple, using 11/2 or 11/4 in. diameter copper tube for the shell, or smaller if necessary; 16g wall thickness is readily available. The square end plates are from 5/32 or 3/16 in. thick brass or copper, machined with a 1/16 in. deep recess or register for the shell tube, as shown. After machining the end plate, the required shell length can be determined.

Phosphor bronze bushes are required for the connections, and it is suggested that the filler cap be not less than 3/8 in. diameter for ease of filling, and the others 5/16 or 1/4 in. depending on tank size.

The corner of the end plates are drilled for fixing.
The tank must be fully silver soldered and should be tested as part of the boiler system in its intended location. Reference should be made to your club boiler tester for view on the testing of the tank.

Steam supply and condensing pipe.
The steam supply should be taken from the boiler manifold or suitable alternative position on the boiler. A valve similar to a standard blower valve is required at the manifold or in the steam pipe as near as possible to the steam source. This valve is nothing more than an on/off control.

A 1/8 in. steam pipe is run from the valve to the bottom of the tank. This pipe acts as a condensor and should not be less than 24 in. long. If the tank is under the cab, the

excess pipe should be coiled and hidden, perhaps under a side tank or under a running board. With the tank at the front buffer beam it is likely that only a short excess length of pipe, if any, will have to be coiled.

Drain valve.
The drain valve fitted to the bottom of the tank can be a quick opening needle valve combined with the steam inlet connection as shown on the drawing. Alternatively it can be a separate connection, which can be a plug or blow down type valve. The drain valve is normally only used only to drain condensate at the end of the day's running. The drain should be made large enough to drain the steam oil if necessary.

Oil supply pipe to cylinders.
This is taken from the top of the tank, or the bottom with an internal pipe as shown on the drawing, via a needle valve to the main steam pipe to the cylinders. The valve can be fitted either directly to the tank or in a convenient location in the oil pipe to the cylinders.
Wherever it is fitted, the needle valve must have very fine control. The valve port should be no larger than 0.075 in. dia. With the valve spindle having a very long taper. This will give very fine control; the finer the better, as a mere quarter turn adjustment could mean the difference between too much or too little oil. Keith's Simplex needed less than one half of a turn to open sufficiently with a 40 tpi valve spindle thread.
The pipe from the valve to the cylinders can be 1/8 in. dia. From wherever the tank is situated as the oil flow is so small that the pressure losses are negligible.
Ideally, the connection at the cylinder end should be into a point on the common steam pipe after the superheater hot header.

Commissioning.
The oil should be of the heaviest steam grade available, light grades have a tendency to emulsify in the tank. Once the tank has been filled with oil, there should never be a need to empty it.
Before raising steam, first ensure that oil and drain valves are closed, and then fill the tank. Being of a high viscosity, the oil will take a few minutes to settle. Once the tank is completely filled to the top fit the filler plug and gasket.
As soon as the fire has been lit, open the steam supply valve but leave the oil valve closed. As pressure builds in the boiler, steam will enter the supply pipe and condense. When the boiler is up to pressure open the oil valve slightly (only half a turn) allowing oil through to slowly fill the pipe to the cylinders; do rush this or the oil and water in the tank could mix and emulsify. With the drain cocks open move the locomotive forward and back a few feet until oil appears at the drain cocks. Shut the oil valve and the system is now full and primed.
If you are going for a first run straight away, crack open the oil valve once you are on the track. Surplus oil from the filling process may be thrown out during the first lap or so. Continue to adjust the valve as necessary so that eventually the inside of the chimney top is a slightly dark grey colour. This is the experimental time, once the ideal valve setting is found, that is where you set it for each time you run.

Normal operating procedure.
Starting up:

1. Open the steam valve when you light the fire: ensure the drain and oil valves are shut.
2. When pressure is raised and the locomotive is ready to run, open the oil valve to the position that you have found suits the locomotive.

End of run shutdown (every time):

1. As soon as you finish your run shut the steam valve and the oil valve.
2. Replenish the oil in the tank by first opening the drain valve to release the pressure.
3. Remove the filler plug only when the pressure is relieved.
4. The water will now run out. As steam oil appears at the drain, shut the drain valve and top up the oil.
5. Refit the filler cap, and you are ready for the next run.

A couple of tips.

1. If during a run you stop for more than five minutes, it pays to shut the steam valve to prevent excess oil feeding to the cylinders, but don't forget to open it again when you move on.
2. If you have cast iron cylinders before shutting down it is often worthwhile to flood some extra oil in by opening the oil valve for a few moments.
3. As far as tank capacity is concerned, the above tank fitted by Keith to his Simplex had a duration of more than ten hours.